PATENT ABSTRACTS OF JAPAN

(11)Publication number : 05-333873

(43)Date of publication of application : 17.12.1993

(51)Int.Cl. G10K 11/16
// H04R 1/10

(21)Application number : 04-163574

(22)Date of filing : 29.05.1992

(71)Applicant : SONY CORP

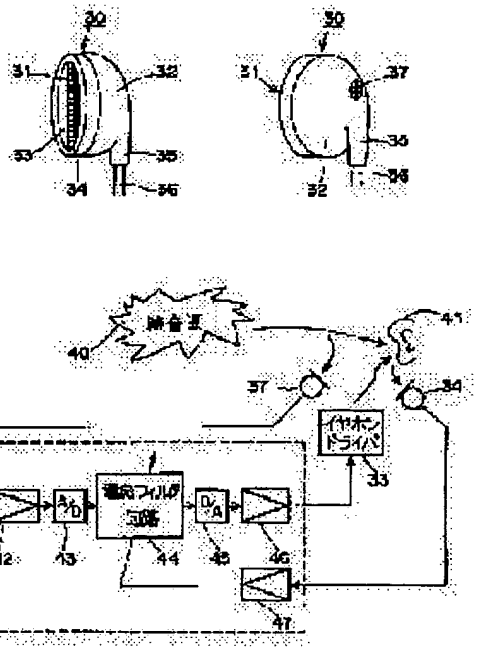
(72)Inventor : GYOTOKU KAORU
SASAKI TORU
OKUBO HITOSHI

(54) NOISE REDUCING DEVICE

(57)Abstract:

PURPOSE: To provide the noise reducing device which has good sound insulating performance and is small in size and comfortably put on.

CONSTITUTION: A mount member 30 mounted in the concha is fitted with a microphone 37 for reference input which absorbs a noise 40, a sound radiating means 33 which radiates a canceling sound directly to the auditory meatus, and a microphone 34 for residue detection which gathers a noise residue nearby the auditory meatus. A canceling sound generating means 44 generates the canceling sound for canceling the noise gathered by the microphone 37 for reference input from the noise. The canceling sound generating means 44 is so adjusted as to minimize the residue signal gathered by the microphone 34 for residue detection.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the small noise reduction equipment which reduces noise acoustically.
[0002]
[Description of the Prior Art] The system which reduces noise is known by forming the sound signal of amplitude, such as noise, an antiphase, etc. from [from the former] a noise source, carrying out sound emission of this sound signal by the loudspeaker, and negating the noise from a noise source.
[0003] Drawing 12 is drawing showing the outline of an example of this kind of noise reduction equipment. That is, in drawing 12 , 11 is a microphone for a reference input for collecting the noise from a noise source 10. The sound signal of the noise acquired from this microphone for a reference input is supplied to the denial sound formation circuit 12, and the sound signal of amplitude [antiphase] is formed to the noise generated from a noise source 10. Sound emission of the denial voice from this denial sound formation circuit 12 is supplied and carried out to a loudspeaker 13, and noise is reduced.
[0004] 15 is a microphone for remainder detection for collecting the noise remainder in the sound field 14 near the ear. The remainder acquired from this microphone for remainder detection is fed back to the denial sound formation circuit 12, and it reforms denial sound in the denial sound formation circuit 12 so that the remainder may become zero.
[0005] By the way, the loudspeaker 13 as an output unit is installed in the room, a hole, etc., and it is made to perform noise reduction in a noise reduction system like drawing 11 mentioned above spatially about the whole room or the whole hole. Moreover, the microphone 11 for a reference input is arranged near the noise source 10, and, as for the microphone 15 for remainder detection, on the other hand, it is ideal correctly human being's ear and to arrange to an eardrum side.
[0006] Moreover, the system which installed the loudspeaker and the microphone 15 for remainder detection in the surroundings of a chair is known conventionally.
[0007]
[Problem(s) to be Solved by the Invention] However, as for this noise reduction system, the position of a loudspeaker and a microphone is installed in the considerably distant position, and eye a large-scale hatchet and movement also have the fault of it being difficult and taking a latus space. Moreover, since the microphone for remainder detection is installed in the predetermined position fixed physically and noise reduction only of the circumference is carried out, the area where noise is reduced is restricted. For this reason, there was a problem to which the noise reduction effect becomes low by movement of human being's head or the body.
[0008] Then, as small noise reduction equipment, as shown in drawing 13 , while being made to carry out [sound / denial] sound emission from a headphone driver, what built the microphone for a reference input

and the microphone for remainder detection into these headphone is considered.
[0009] That is, drawing 13 shows the headphone to the ear of one side, and 20 shows the headphone as a whole. The headphone driver 21 is formed in the interior of these headphone 20. Moreover, an ear pad 22 is formed in a part for the applied part in contact with human being of these headphone 20. And when human being is equipped with these headphone 20, the microphone 23 for reference is attached in the tooth-back portion by the side of reverse with the portion which carries out opening outside, i.e., the direction where sound emission of the acoustic wave is carried out from the headphone driver 21. This microphone 23 for a reference input is a microphone for collecting the noise generated around an ear, and the diaphragm side is arranged towards the exterior of headphone.
[0010] Moreover, covering 24 is formed in the front face of the direction of sound emission of the headphone driver 21, and the diaphragm side is arranged at this covering 24, as the microphone 25 for remainder detection turns to the headphone driver 21 side. In this case, two microphones 23 and 25 have been arranged on both sides of the headphone driver 21, and the difference of the path about [required for the processing for making the remainder into the minimum in the denial sound formation circuit 12] time is established.
[0011] According to the noise reduction equipment by this headphone system, the noise insulation effect by the headphone other than headphone being smaller than the above-mentioned system itself serves as a big merit.
[0012] However, with these headphone type noise reduction equipment, the surrounding feeling of oppression of the ear by the ear pad 22 poses a problem, and prolonged wearing has the fault which gives a remarkable feeling of defatigation to human being. Moreover, although it is a compact, for a cellular phone, a miniaturization is desired further.
[0013] In view of the above point, this invention is more compact, and its feeling of wearing is good and it aims at offering the noise reduction equipment which enabled it to be equal also to prolonged wearing.
[0014]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the noise reduction equipment by this invention When the reference mark of the below-mentioned example was made to correspond and it is equipped with the carrying member 30 (or 50) with which it is equipped in a concha, and this carrying member in the aforementioned concha The microphone 37 (or 54) for a reference input for this carrying member being attached in the portion exposed outside, and collecting noise, The denial sound means forming 44 which forms the denial sound for negating this noise from the noise which collected the sound with this microphone for a reference input, The sound emission means 33 (or 55) for being attached in the aforementioned carrying member and carrying out [sound / denial / aforementioned] sound emission directly to auditory meatus, It is attached in the aforementioned carrying member and has the microphone 34 (or 56) for remainder detection for collecting the noise remainder near [by which sound emission was carried out from the aforementioned sound emission means / where it denied and noise reduction was carried out / sound] the auditory meatus. The remainder signal collected with the aforementioned microphone for remainder detection denies, the sound means forming 44 is supplied, and this denial sound means forming 44 is adjusted so that the aforementioned remainder may become the minimum.
[0015]
[Function] By the denial sound means forming 44, noise denial sound is formed from the sound signal from the microphone for a reference input. Sound emission of this noise denial sound is carried out by the sound emission means to auditory meatus. The microphone for remainder detection collects the noise remainder near [this] the auditory meatus. The collected remainder signal is supplied to denial sound means forming, and it is adjusted so that the remainder may become [this denial sound means forming] the minimum.
[0016] Since the microphone for a reference input, a sound emission means, and the microphone for remainder detection are attached in the carrying member with which it is equipped in a concha, it is small and the good noise reduction equipment of a feeling of wearing is obtained.

[0017]
[Example] Hereafter, some examples of the noise reduction equipment by this invention are explained, referring to drawing.
[0018] The carrying member of the example of the noise reduction equipment of this invention explained below is a so-called earphone type thing. The configuration of an earphone is roughly divided, there are two kinds, and one of them is only a type (it is hereafter called Type A) which equips the auditory-meatus entrance in a concha with the main part of an earphone of a disk-like configuration. Moreover, other one is a type (it is called Type B below) which has an insertion portion to auditory meatus.
[0019] First, the example in earphone type [A] is explained, referring to drawing 1 . Although the fundamental composition of this invention attaches earphone drivers, the microphones for a reference input, and all the microphones for remainder detection in an earphone, the composition of this type A of case arranges the small microphone for a reference input towards the earphone exterior while it adjoins an earphone driver and forms the small microphone for remainder detection.
[0020] That is, in drawing 1 , 30 shows the earphone of a disk-like configuration as a whole. The whole is contained by the crevice of the auditory-meatus entrance portion in a concha, and an ear is equipped with this earphone 30.
[0021] As shown in drawing 1 A, the whole surface 31 side of this earphone 30 is made into a sound emission side, and it is attached so that the earphone driver 33 may turn to this field 31 side for the direction of sound emission. When it equips with an earphone 30 in a concha, the sound emission acoustic wave from the earphone driver 33 is directly emitted to an auditory-meatus entrance from this field 31. Moreover, the microphone 34 for remainder detection is attached in the center section of this field 31, and it consists of this example so that the noise remainder in the auditory-meatus entrance space where noise is negated by the sound emission acoustic wave from the earphone driver 33 may be detected.
[0022] In the sound emission side 31 of an earphone 30, the field 32 of an opposite side is exposed outside, when it equips with an earphone 30 in a concha. The earphone code connection 35 is formed and the earphone code 36 is drawn from this connection 35 at the field 32 side exposed to this exterior. Moreover, the diaphragm is turned outside, and the microphone 37 for a reference input is attached in this field 32 side so that the noise from the outside may be collected.
[0023] In this type A of example, the earphone driver 33 and the installation position of the microphone 34 for remainder detection are not restricted to the example shown in drawing 1 A.
[0024] Drawing 2 and drawing 3 show other examples of the installation position of the earphone driver 33 and the microphone 34 for remainder detection, and they carry out area division of the sound emission side 31 side of an earphone 30 spatially, and it is made to all secure the installation position of the earphone driver 33 and the microphone 34 for remainder detection. That is, in the example of drawing 2 , the field side which meets an auditory-meatus entrance is divided into two, and let sound emission space according semicircle space of one of these to the earphone driver 33, and semicircle space of another side be the positions for attaching the microphone 34 for remainder detection.
[0025] Moreover, the example of drawing 3 is put on the position where the center carried out eccentricity of this earphone driver 33 from the center of the circular portion of a field 31 while it makes smaller than the circular portion of a field 31 the size of the earphone driver 33 which has a circular sound emission side. And this earphone driver 33 attaches the microphone 34 for remainder detection in the space of the crevice produced according to a small thing.
[0026] And in the example of circuitry of the noise reduction equipment by this invention, an adaptation processing circuit is used for noise reduction. An ecad noise reduction circuit is explained referring to drawing 4 , before explaining this example. In drawing 4 , 1 is a main input terminal, 2 is a reference input terminal, and the signal inputted through the main input terminals 1 is supplied to the synthetic circuit 4 through a delay circuit 3. Moreover, the signal inputted through the reference input terminal 2 is supplied to the synthetic

circuit 4 through the adaptation filter circuit 5. And the output of this synthetic circuit 4 is drawn by the output terminal 6 while it returns to the adaptation filter circuit 5.
[0027] It sets to this noise reduction equipment, and is the noise n0 of the signal s of choice, this, and no correlating with the main input terminals 1. What was added is inputted. On the other hand, in the reference input terminal 2, it is noise n1. It is inputted. Noise n1 of this reference input The signal of choice is noise n0, although not correlated. It is made for there to be correlation.
[0028] The adaptation filter circuit 5 is the reference input noise n1. It filters and is noise n0. The signal y to approximate is outputted. And in the synthetic circuit 4, processing which subtracts the output signal of the adaptation filter circuit 5 from the output signal of a delay circuit 3 is performed. A delay circuit 3 takes into consideration the processing time in the adaptation filter circuit 5.
[0029] The algorithm of the adaptation in the adaptation filter circuit 5 works so that the subtraction output (remainder output) e which is an output of the synthetic circuit 4 may be made into the minimum. That is, if s, n0, n1, and y assume now that it is statistically regular and the average is 0, the remainder output e will be set to e=s+n0-y. For expected value, s is n0 although this was squared. Since it did not correlate with y again E [e2] =E[s2]+E [(n0-y)2] +2E [s (n0-y)]
=E[s2]+E[(n0 -y)2]
It becomes. The thing which the adaptation filter circuit 5 converges, then the adaptation filter circuit 5 are adjusted so that E [e2] may become the minimum. Since E [s2] is not influenced at this time Emin [e2] =E[s2] +Emin [(n0-y)2]
It becomes. That is, by minimizing E [e2], E [(n0-y)2] is minimized and the output y of the adaptation filter circuit 5 is noise n0. It becomes estimate. And the expected value of the output from the synthetic circuit 4 serves as the signal s of choice. That is, adjusting the adaptation filter circuit 5 and minimizing full power power has the subtraction output e equal to the least squares estimate of the sound signal s of choice to a bird clapper.
[0030] In addition, either in the case of realizing in the case where it realizes in an analog signal processing circuit, and a digital-signal-processing circuit is possible for the adaptation filter circuit 5. The example at the time of realizing the adaptation filter circuit 5 using a digital filter is shown in drawing 5 . The so-called LMS (the minimum average square) method is used for this example as an algorithm of adaptation.
[0031] As shown in drawing 5 , in this example, the FIR filter type adaptation linear combination machine 300 is used. This is [two or more delay circuits DL1 and DL2 which have the time delay Z-1 of the unit sampling time, respectively, ...DLm (m is a positive integer) and] the input noise n1. And it has the adder circuit 310 adding each delay circuits DL1 and DL2, the load circuits MX0, MX1, and MX2 which perform multiplication of the output signal of ..DLm, and a weighting factor, ..MXm, and the output of the load circuits MX0-MXm. The output of an adder circuit 310 is y.
[0032] The weighting factor supplied to the load circuits MX0-MXm is the LMS arithmetic circuit 320 which consists of a microcomputer, and is formed based on the remainder signal e from the synthetic circuit 4. The algorithm performed in this LMS arithmetic circuit 320 is as follows.
[0033] Now and time k Input vector Xk which can be set As shown also in drawing 5 , it is Xk =[x0k x1k x2k. ... It is [0034], as input / output relation shows yk and a weighting factor to the following several 1 for it by being referred to as xmk]T, when an output is set to wjk (j= 0, 1 and 2, --m).
[Equation 1]

$$y_k = \sum_{j=0}^{m} w_{jk} x_{jk}$$

It becomes.
[0035] And time k Load vector Wk which can be set Wk =[w0k w1k w2k ... If it is defined as wmk]T,

input/output relation will be given by yk =Xk T and Wk. Here, it is dk about the response of hope. Then, the remainder ek It is expressed as follows.
With ek =dk-yk=dk-Xk T and the WkLMS method, it is Wk+1 =Wk+2 micro-ek about renewal of a load vector. The formula which becomes -Xk performs one by one. Here, mu is an advantage factor (step gain) which determines the speed and stability of adaptation.
[0036] With the noise reduction equipment which is the object of this invention, the synthetic circuit 4 serves as a sound composition means. That is, by the adaptation filter circuit 5, an amplitude does noise denial sound signal-y formation of noise, an antiphase, etc., this is supplied to the earphone driver 33, and it considers as the composition which adds to the noise which is main voice acoustically, and carries out noise reduction. the remainder e in this case collects a sound with the microphone 34 for remainder detection -- things -- **
[0037] Drawing 6 is the circuitry view of one example of the noise reduction equipment by this invention. In this example, the thing using a digital filter which mentioned the adaptation filter circuit above is used. And only the noise source 40 is considered as a main input. As the noise from this noise source 40 is shown in drawing, it is spread to an ear 41.
[0038] At this time, the noise inputted into an ear is simultaneously collected with the microphone 37 for a reference input attached in the superficies 32 of the earphone 30 with which the ear is equipped. The signal which was collected with this microphone 37 for a reference input, was changed into the electrical signal, and was acquired is supplied to A/D converter 43 through amplifier 42, is changed into a digital signal and supplied to the adaptation filter circuit 44. And the output signal of this adaptation filter circuit 44 is returned to an analog sound signal by D/A converter 45, and is supplied to the earphone driver 33 through amplifier 46. And sound emission of the noise denial sound is carried out to an auditory-meatus entrance by this earphone driver 33, it is acoustically compounded with the noise acoustic wave from a noise source 40, and the noise from a noise source 40 is reduced at the auditory-meatus entrance of an ear 41.
[0039] And the noise remainder of an auditory-meatus entrance is collected with the microphone 34 for remainder detection which adjoined the earphone driver 33 and was attached in the earphone 30. The remainder of the auditory-meatus entrance of the ear 12 collected with this microphone 41 for remainder detection is supplied to the adaptation filter circuit 44 through amplifier 47. This application filter circuit 44 adjusts the output signal so that the remainder may serve as the minimum. In this way, noise reduction is carried out in adaptation so that the noise in the auditory-meatus entrance of an ear 12 may become the minimum.
[0040] In this example, in an earphone 30, the portion to the amplifier 42 surrounded by the dotted line in drawing - amplifier 47 is carried as another object, and can be connected with an earphone 30 in code. In this case, the pocket machine side can be equipped with the cell as a power supply. In addition, it is easy to be natural even if it also includes the portion to amplifier 42 - amplifier 47 in an earphone 30 and one.
[0041] Next, the example of this invention in earphone type [B] is explained. It is supposed that circuitry is [of drawing 6] the same also in this example. Since there is a portion inserted in auditory meatus in the case of the earphone of Type B, the microphone for a reference input and the microphone for remainder detection are attached using this insertion section. In the case of this type B of example, compared with the case of the former example, there is the feature that the building envelope at the time of wearing can obtain volume suitable by near and small-size width of face to sealing mostly as small air space.
[0042] The example of this type B of case is shown in drawing 7 , drawing 8 , drawing 9 , drawing 10 , and drawing 11 , respectively.
[0043] In drawing 7 - drawing 11 , 50 expresses this type B of earphone as a whole. As shown in drawing, this earphone 50 is the auditory-meatus interpolation admission into a club 51 which is carrying out the cylinder-like configuration of having a centrum 52, this auditory-meatus interpolation admission into a club 51, and one, and is equipped with the major-diameter section 53 with a larger path than the insertion section 51. The major-diameter section 53 is exposed outside, when an ear is equipped with an earphone 50. Also in

which example, the microphone 54 for a reference input is attached in the tooth-back portion of the major-diameter section 53 exposed outside, and makes surrounding noise detectable.
[0044] And in the example of drawing 7 , the earphone driver 55 is formed in the pars basilaris ossis occipitalis of the centrum 52 of the auditory-meatus interpolation admission into a club 51. Moreover, the microphone 56 for remainder detection also approaches the earphone driver 55, and is formed in the pars basilaris ossis occipitalis of a centrum 52 so that the noise remainder in the centrum 52 by which voice is reproduced by the earphone driver 55 can be detected.
[0045] In the case of the example of this drawing 7 , since the auditory-meatus interpolation admission into a club 51 exists and the microphone 56 for remainder detection is formed in the centrum 52, it can prevent collecting the fricative which this microphone 56 for remainder detection touches and generates to the direct skin.
[0046] In the example of drawing 8 , the earphone driver 55 is formed in the side in the pars intermedia of the centrum 52 of the auditory-meatus interpolation admission into a club 51. On the other hand, the microphone 56 for remainder detection is formed in the pars basilaris ossis occipitalis of a centrum 52.
[0047] since the same effect as the example of drawing 7 can be acquired upwards in the case of the example of this drawing 8 and the distance of the earphone driver 55 and the microphone 56 for remainder detection becomes larger than the example of drawing 7 , what the spatial path between both (voice propagation path) can be lengthened, and the processing time in the adaptation filter circuit 44 is lengthened for is possible
[0048] The example of drawing 9 is an example for which the position of the earphone driver 55 and the microphone 56 for remainder detection has reversed the example of drawing 8 , the earphone driver 55 is formed in the pars basilaris ossis occipitalis of the centrum 52 of the auditory-meatus interpolation admission into a club 51, and, on the other hand, the microphone 56 for remainder detection is formed in the middle insertion circles of this centrum 52.
[0049] The noise which invaded from the outside of an earphone 50, and the sound signal generated in the earphone driver 55 can be added, and the example of these drawing 8 and drawing 9 is in the state which denied acoustically and existed, can be spread to the eardrum, and can detect the process with the microphone 56 for remainder detection.
[0050] The example of drawing 10 is an example which attached both the earphone driver 55 and the microphone 56 for remainder detection in the side-attachment-wall portion of the pars intermedia of the centrum 52 of the auditory-meatus interpolation admission into a club 51. In this example, while the path between both can be secured comparatively long, the state where system output and a noise signal denied and there were can detect with the microphone 56 for remainder detection, and it comes to spread to the eardrum.
[0051] Although the example of drawing 11 is considered as the arrangement as the example of drawing 7 arranged at the pars basilaris ossis occipitalis of the centrum 52 of the auditory-meatus interpolation admission into a club 51 with same earphone driver 55 and microphone 56 for remainder detection, it is an example which formed the partition 57 for lengthening more the voice wave propagation path between the earphone driver 55 and the microphone 56 for remainder detection in the centrum 52. If it does in this way, the path from the earphone driver 55 to the microphone 56 for remainder detection can take the comparatively long processing time in the adaptation filter circuit 44 by the bird clapper for a long time. Therefore, in the adaptation filter circuit 44, there is a merit for which so high-speed processing is not needed.
[0052] In addition, since securing a long path like the example of this drawing 11 does not pose a problem in the system which can be processed high-speed, the optimal arrangement is chosen in consideration of the whole system.
[0053]
[Effect of the Invention] Since the microphone for a reference input and the microphone for remainder detection were formed in the earphone of the type with which an auditory-meatus entrance is equipped, or the type with which it equips in auditory meatus according to this invention as explained above, very small noise

reduction equipment is realizable.

[0054] According to such small compact noise reduction equipment, noise insulation nature improves, moreover there is no feeling of oppression like a headphone type which was mentioned above, and it is effective in the ability to be equal to prolonged use. Since it is moreover very small and lightweight, there is also an advantage which is that it is convenient to carry.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, as for this noise reduction system, the position of a loudspeaker and a microphone is installed in the considerably distant position, and eye a large-scale hatchet and movement also have the fault of it being difficult and taking a latus space. Moreover, since the microphone for remainder detection is installed in the predetermined position fixed physically and noise reduction only of the circumference is carried out, the area where noise is reduced is restricted. For this reason, there was a problem to which the noise reduction effect becomes low by movement of human being's head or the body.

[0008] Then, as small noise reduction equipment, as shown in drawing 13 , while being made to carry out [sound / denial] sound emission from a headphone driver, what built the microphone for a reference input and the microphone for remainder detection into these headphone is considered.

[0009] That is, drawing 13 shows the headphone to the ear of one side, and 20 shows the headphone as a whole. The headphone driver 21 is formed in the interior of these headphone 20. Moreover, an ear pad 22 is formed in a part for the applied part in contact with human being of these headphone 20. And when human being is equipped with these headphone 20, the microphone 23 for reference is attached in the tooth-back portion by the side of reverse with the portion which carries out opening outside, i.e., the direction where sound emission of the acoustic wave is carried out from the headphone driver 21. This microphone 23 for a reference input is a microphone for collecting the noise generated around an ear, and the diaphragm side is arranged towards the exterior of headphone.

[0010] Moreover, covering 24 is formed in the front face of the direction of sound emission of the headphone driver 21, and the diaphragm side is arranged at this covering 24, as the microphone 25 for remainder detection turns to the headphone driver 21 side. In this case, two microphones 23 and 25 have been arranged on both sides of the headphone driver 21, and the difference of the path about [required for the processing for making the remainder into the minimum in the denial sound formation circuit 12] time is established.

[0011] According to the noise reduction equipment by this headphone system, the noise insulation effect by the headphone other than headphone being smaller than the above-mentioned system itself serves as a big merit.

[0012] However, with these headphone type noise reduction equipment, the surrounding feeling of oppression of the ear by the ear pad 22 poses a problem, and prolonged wearing has the fault which gives a remarkable feeling of defatigation to human being. Moreover, although it is a compact, for a cellular phone, a miniaturization is desired further.

[0013] In view of the above point, this invention is more compact, and its feeling of wearing is good and it aims at offering the noise reduction equipment which enabled it to be equal also to prolonged wearing.

[Translation done.]

* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] Since the microphone for a reference input and the microphone for remainder detection were formed in the earphone of the type with which an auditory-meatus entrance is equipped, or the type with which it equips in auditory meatus according to this invention as explained above, very small noise reduction equipment is realizable.
[0054] According to such small compact noise reduction equipment, noise insulation nature improves, moreover there is no feeling of oppression like a headphone type which was mentioned above, and it is effective in the ability to be equal to prolonged use. Since it is moreover very small and lightweight, there is also an advantage which is that it is convenient to carry.

[Translation done.]

* NOTICES *

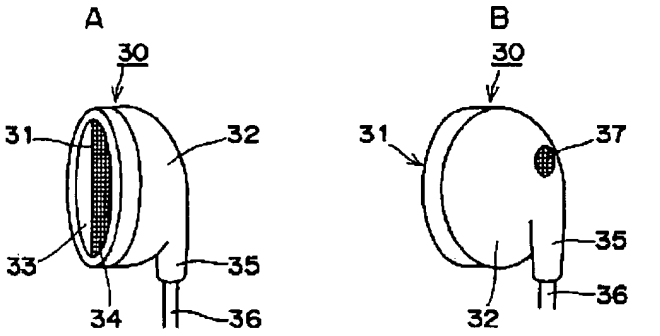
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing an example of the carrying member of the noise reduction equipment by this invention.
[Drawing 2] It is drawing showing other examples of the carrying member of the noise reduction equipment by this invention.
[Drawing 3] It is drawing showing other examples of the carrying member of the noise reduction equipment by this invention.
[Drawing 4] It is drawing showing the outline of an adapted type noise reduction system.
[Drawing 5] It is drawing showing an example of an adaptation filter circuit.
[Drawing 6] It is drawing showing an example of the circuitry of the noise reduction equipment of this invention.
[Drawing 7] It is drawing showing other examples of the carrying member of the noise reduction equipment by this invention.
[Drawing 8] It is drawing showing other examples of the carrying member of the noise reduction equipment by this invention.
[Drawing 9] It is drawing showing other examples of the carrying member of the noise reduction equipment by this invention.
[Drawing 10] It is drawing showing other examples of the carrying member of the noise reduction equipment by this invention.
[Drawing 11] It is drawing showing other examples of the carrying member of the noise reduction equipment by this invention.
[Drawing 12] It is drawing showing the outline of the system which carries out noise reduction acoustically.
[Drawing 13] It is drawing showing the example of the important section of the noise reduction equipment proposed previously.
[Description of Notations]
30 50 Earphone
33 55 Earphone driver
34 56 Microphone for remainder detection
37 54 Microphone for a reference input
44 Adaptation Filter Circuit

[Translation done.]

Drawing selection [Representative drawing]



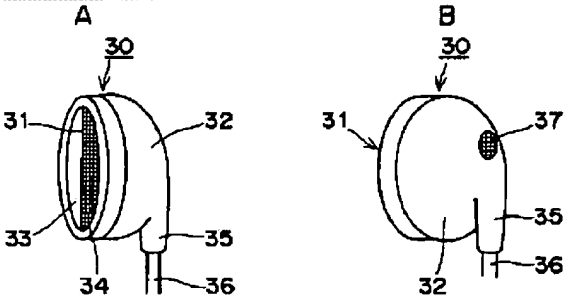
[Translation done.]

* NOTICES *

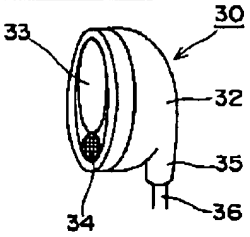
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

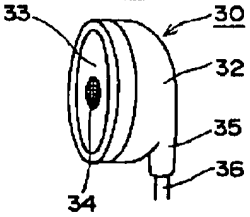
[Drawing 1]



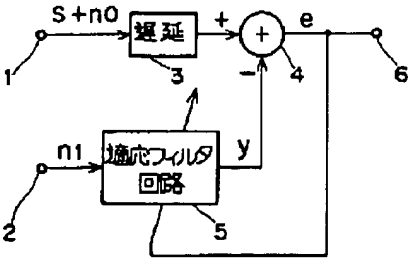
[Drawing 2]



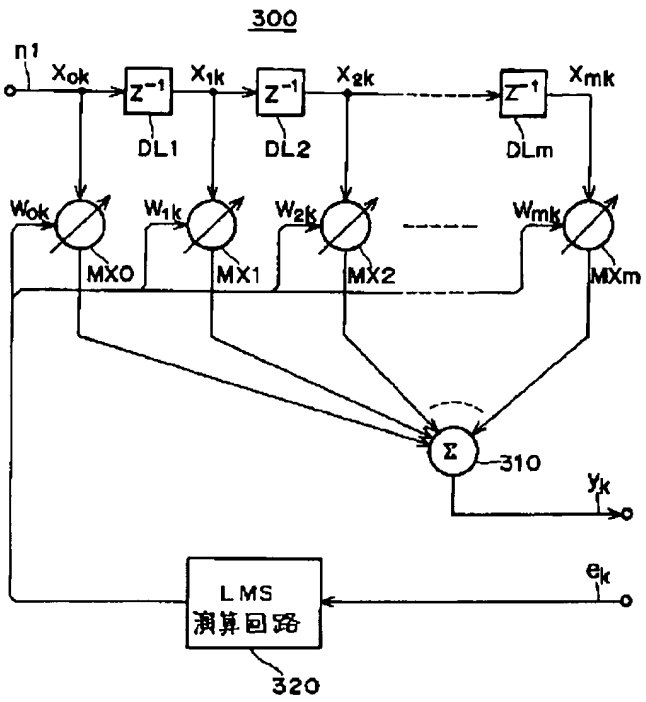
[Drawing 3]



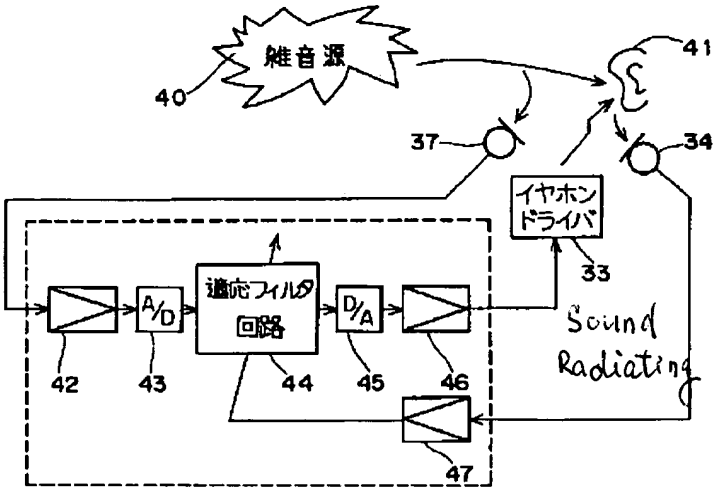
[Drawing 4]



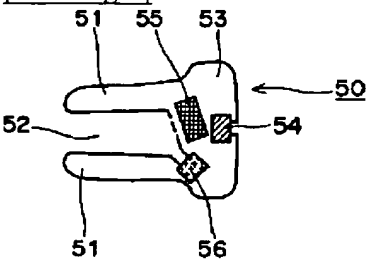
[Drawing 5]



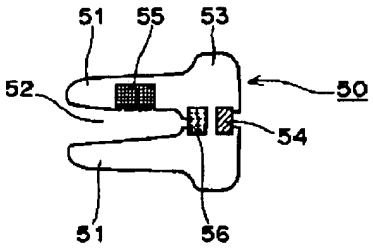
[Drawing 6]



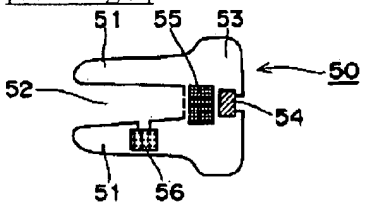
[Drawing 7]



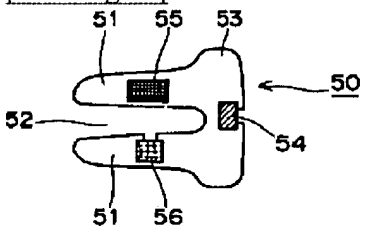
[Drawing 8]



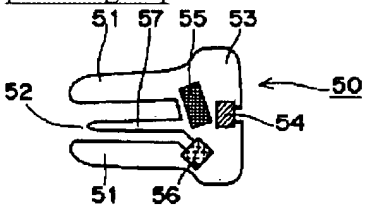
[Drawing 9]



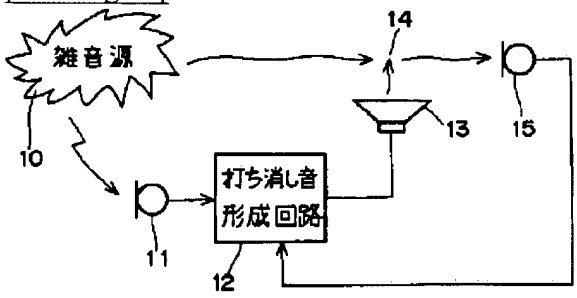
[Drawing 10]



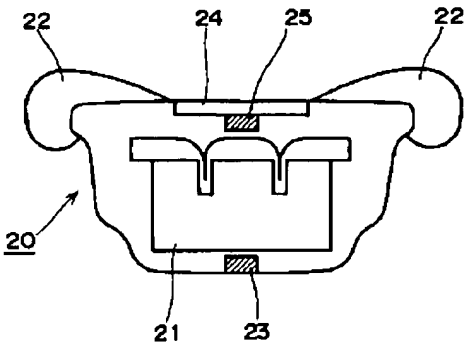
[Drawing 11]



[Drawing 12]



[Drawing 13]



[Translation done.]